1854MNRAS..15...31H

variations of magnetism due to meteorological influences and auroras, or to any other cause of irregular perturbation, since I have taken into consideration only the effects of the sun, and even neglected some small parts and coefficients, which may become sensible perhaps in individual cases, and explain minor periods.

"*Roman College Observatory,*
"*Rome, Sept.* 9, 1854."

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## *On Saturn's Rings.* By J. R. Hind, Esq.

"In the *Monthly Notice* of this Society for June 1853, is given an extract from a letter of Sig. Secchi's, addressed to Capt. Manners, R.N., referring to a drawing of *Saturn's* ring, executed by Campani at Rome in 1664, and considered to afford confirmatory evidence of that remarkable conclusion deduced by M. Otto Struve,—that the ring is contracting upon the ball at a rate which at no distant period may bring it into contact with the globe.

"I have not seen it noticed anywhere in print, that the first volume of Lubienietski's *Theatrum Cometicum* contains a well-engraved sketch of the appearance of *Saturn* and his ring, no doubt founded upon the drawing, the original of which was forwarded by Signor Secchi to Capt. Manners.* It accompanied a letter from Father Athanasius Kirch to Lubienietski, dated Rome, 1665, July 25, and is thus alluded to in that communication,—'*Mitto hisce inclusum Systema Saturninum à Campano ingeniosissimo Telescoplopœo* 50 *palmorum tubo observatum.*' It appears to have been taken at the end of July 1664, when the ring was very open. On measuring the relative breadths of the ring and the dark space between the interior edge and the ball, the latter is seen to be very slightly the broadest. Reducing the dimensions to seconds of arc with M. Otto Struve's value for the equatoreal diameter of the globe, I find for the breadth of the rings 5″·58 and of the dark space 5″·77. These numbers agree very well with the relative breadth inferred from a remark of Huyghens, in his *Systema Saturnium*, applicable to the year 1657,—that the breadth of the interval between the interior border of the ring and the body of the planet was equal to, or perhaps rather exceeded, the breadth of the ring. M. Otto Struve argues that this observation of Huyghens, when taken in comparison with recent measures, is alone sufficient to prove that a very considerable change has occurred in the system of the rings since the middle of the seventeenth century: Campani's drawing is certainly rather favourable than otherwise to this view.

"The roughly executed diagram of *Saturn* and his ring, at the time of the greatest inclination of its plane to our line of vision in July 1667, found in Lemonnier's *Histoire Céleste*,—

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* See *Monthly Notice* for June 1853.

though apparently less deserving of confidence than that given by Lubienietski, may be worth mention, as the evidence it affords, whether reliable or not, tends to support M. Otto Struve's inference. In this sketch the breadth of the dark space, compared with that of the rings, is about as 3 to 2. The diminished breadth of the space in the diagrams which follow may be accounted for by the closing up of the rings and the imperfections of telescopes in those times. It should be remarked, however, that Picard's avowed object in presenting this drawing, taken in July 1667, was to point out the extension of the ring beyond the edge of the globe, and had no reference to the comparative breadths of the ring and dark interval.

"I have found amongst Picard's observations on the ring, in the same work, a notice of that second dark belt, traversing the globe at the interior edge of the rings, which, with every appearance of probability, has been identified with the obscure ring of modern observers. M. Otto Struve alludes to observations of this nature made early in the eighteenth century; but probably Picard's had escaped his notice. Under date 1673, June 15, it is remarked, '*Saturne étoit sorti des raïons du soleil: il y avoit deux barres noires qui marquoient les deux bords intérieurs et extérieurs de l'anneau.*' A rough sketch is annexed to illustrate the observation. It appears difficult to account for this belt on any other assumption than the above; and we have, therefore, reason to suspect the existence of the obscure ring, at least as far back as 1673, notwithstanding the negative evidence which the subsequent observations of Sir W. Herschel and others may be considered to afford.

"At page 25 of the *Histoire Céleste* are some measures of the diameter of the ring by the same observer in the years 1666 and 1667, and approximate determinations of the angle of position of the greater axis with respect to the meridian. On the following page are also measures of the diameter of *Jupiter*, between October 3d, 1666, and November 10th, 1667; yet, strange to say, Picard does not appear to have remarked the compression at the poles during the interval over which these measures extend, since, in a note dated 1673, April 13, he says, 'I began to perceive that the disk of *Jupiter* was a little oval, and that the greater diameter is always in the direction of the belts.' It is uncertain, therefore, in what direction the planet was measured; but to obtain something like a probable value of the major axis of *Saturn's* ring in 1667, I have compared the measures of *Jupiter* with the mean results of Struve and others, assuming that Picard's numbers represent the *mean* diameters of the planet, and thus have deduced a correction to be applied to the measures of *Saturn*. In this way I find the exterior diameter of the ring = 44″·1 (for *Saturn's* mean distance). If we compare with the values given by the observations of diameter with the meridian instruments at the Royal Observatory, this number would be increased to 47″·1. In either case it is larger than the measures of Bessel, O. Struve, and

1854MNRAS..15...31H

others, now indicate,—a mean of their results being 39″·5 at the same unit of distance. So far, then, as Picard's observations may be considered deserving of reliance, there is evidence that the exterior diameter of the ring is diminishing, with the gradual approach of its inner edge to the ball: the rate of contraction being apparently about 2″ in a hundred years. In saying thus much, however, I am well aware that great uncertainty attaches to any conclusion that we can arrive at on this subject, with the data at present before us."

Those who are interested in the curious theory respecting *Saturn's* rings, recently propounded by M. Otto Struve, and who are of opinion that the observations of the seventeenth century may be to some extent legitimately employed in testing that theory, will find an original representation of the planet and its appendage by Campani, in the MS. *Letter Book* of the Royal Society (vol. i. p. 324). This drawing, which appears on a small slip of paper carefully inserted in the volume, accompanies a letter from Auzout to Oldenburg, in which the writer states that it had been forwarded by Campani himself in a letter to Cassini, who was then residing at Paris. It is dated October 5, 1665. There are also two drawings of *Saturn*, as seen by Cassini in the years 1676 and 1677, to be found at page 584 of vol. x. of the *Hist. Anc. Acad. des Sciences.* It may be remarked that the interesting observation of Picard's respecting the spheroidal figure of *Jupiter*, which is cited by Mr. Hind in the foregoing paper, is the earliest *distinct* recognition of a real ellipticity of any of the celestial bodies which is to be found in the records of astronomical science, as the writer of this note has recently shown, it is to be hoped satisfactorily, in a paper *On the Early History of the Researches of Astronomers relative to the Spheroidal Figure of the Earth*, which is inserted in the *Monthly Notice* for June of this year (vol. xiv. p. 232), and to which the reader is referred for various other original notes and observations of a similar kind to that of the French astronomer. The remark of Picard is the more creditable to the acuteness and sagacity of that admirable astronomer, when it is considered that hitherto no other individual, with the exception of perhaps Cassini, appears to have entertained the remotest suspicion of the ellipticity of the planet, notwithstanding that it had been the object of continual scrutiny by observers since the invention of the telescope about the beginning of the seventeenth century. As regards Cassini, it may be stated, that, down to the year 1690, he had not entertained *a decided conviction* of the ellipticity of the planet, since in that year we find him still impressed with the idea that its disk was quite round, as is evident from the following passage extracted from the Registers of the Academy of Sciences of Paris for the year 1690:—" *M. Cassini remarqua à cette occasion que Jupiter, qui lui avait parût autrefois d'une figure un peu ovale, dont le*

1854MNRAS..15...34.

*plus grand diametre tendait d'orient en occident lui paraissait à present parfaitement rond.*"—(*Hist. Anc. Acad. des Sciences*, vol. ii. p. 108.) In the very next year he announced definitively the spheroidal figure of the planet, and assigned to the ellipticity a value which appears to be about as good as any that has since been given.—EDITOR.

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## *First Elements and Ephemeris of Polyhymnia,*

Computed by Mr. George Rümker, from the following Observations :—

| | |
|---|---|
| Paris, | Oct. 29, 1854. |
| Berlin, | Nov. 3, |
| Durham, | Nov. 9, |

| | ° | ′ | ″ | |
|---|---|---|---|---|
| Mean Anomaly | 36 | 2 | 51·0 | 1854, Nov. 10·0, G.M.T. |
| Perihelion | 325 | 13 | 54·0 | Mean Eq. 1854, Jan. 0·0 |
| Node | 13 | 55 | 38·3 | |
| Inclination | 2 | 27 | 59·1 | |
| Angle of Eccentricity | 23 | 46 | 42·9 | |
| Log. $a$ | 0·505894 | | | |
| Log. $\mu$ | 2·791166 | | | |

These elements represent the middle observation with errors,—
(Calculation — Observation) + 0″·2 in Longitude, 0·0 in Latitude.

The foregoing elements were accompanied with an Ephemeris of the planet, extending from Nov. 14 to Dec. 16.

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Mr. E. B. Powell writes, that in his paper on the elements of Comet II. 1854 (see *Monthly Notices*, vol. xiv. p. 221), he unfortunately, by an oversight, inserted wrong numbers for the errors of anomaly. The following are the correct numbers and the resulting elements as now furnished by him :—

$v - u = -45''$ for the error of anomaly between the 8th and 13th
$v' - u' = -11''$ — — — 8th and 18th
$v'' - u'' = +(1' - 30'')$ — — — 8th and 27th

Taking the means of the results afforded by the angles for the two latter intervals, the following elements are obtained :—

Time of Perihelion Passage ............ = March 24·03468
Perihelion Distance ...................... = ·2783
Inclination of Orbit ...................... = 81° 44′
Longitude of Perihelion on Ecliptic... = 170° 16′
Longitude of Ascending Node......... = 316° 0′

Motion retrograde.

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At the close of the meeting the President alluded to the curious theory which had been recently started, relative to the